

# Spline based Sparseness and Smoothness for Partially Nonlinear Model via C-fused Lasso

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## Abstract

A useful model for data analysis is partially nonlinear models (PNLRM) where response variable is represented as sum of a nonparametric and a parametric component. Since the model includes the coefficients of both the parametric and nonparametric parts, the complexity of the model will be high and its interpretation will be very difficult. In this study, we propose a procedure that not only achieves the sparseness but also smoothness for PNLRM to obtain a simpler model that better explains the relationship between the response and co-variates. In the proposed method, the fused lasso problem is taken into account where nonparametric components are expressed as a spline basis function, and then Fused Lasso estimation problem is built and expressed in terms of conic quadratic programming which is solved interior point method. An application study is conducted to evaluate the performance of the proposed method by considering some well-known performance measures. The results are compared against parametric nonlinear model.

## Keywords

Nonlinear model, Nonparametric regression, Estimation, Fused lasso, Spline function, Continuous optimization.

## References:

- Ben-Tal, A., and A. Nemirovski (2001). Lectures on Modern Convex Optimization: Analysis, Algorithms and Engineering Applications, MPS-SIAM Series on Optimization, Philadelphia, SIAM.
- Tibshirani, R., M. Saunders, S. Rosset, J. Ji Zhu, and K. Knight (2005). Sparsity and smoothness via the fused lasso. *Journal of Royal Statistical Society B*, 67(1): 91–108.
- Ruppert, D., M. P. Wand, and R. J. Carroll (2003). *Semiparametric Regression*. Cambridge, Cambridge University Press.
- Hastie, T., R. Tibshirani and J.H. Friedman (2001). *The Elements of Statistical Learning*, New York, Springer.